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GUMMATOUS INFILTRATION  
OF THE  
AURICULO-VENTRICULAR BUNDLE.**

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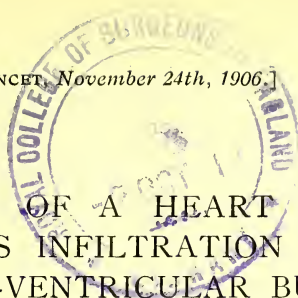
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## DESCRIPTION OF A HEART SHOWING GUMMATOUS INFILTRATION OF THE AURICULO-VENTRICULAR BUNDLE.

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IN THE LANCET recently<sup>1</sup> Dr. Charles W. Chapman recorded the remarkable case of a man who for some 12 years before his death had a slow pulse—about 42 beats per minute—and great dilatation of the veins of the right side of the abdominal wall. Dr. Chapman had shown the patient at the Clinical Society in 1898 and again in 1899; and we are indebted to him for his kindness in allowing us to make use of the very full clinical record of the case as reported in the Transactions of the Clinical Society.<sup>2</sup>

A man, aged 48 years, was admitted into the National Hospital for Diseases of the Heart on October 6th, 1897. He complained of occasional palpitation on exertion and a shooting pain in the head. He further complained of a sense of suffocation when he leaned forward. Twenty years before he had a small itching sore on the penis which caused him no inconvenience and for which he had two months' treatment (1877). His first illness of any note was influenza in 1892, and the attack was a severe one. Six months later he began to suffer from palpitation; three months later, from a sudden sense of fulness in the head, accompanied by swelling and redness of the face which soon passed off. About this time he saw a medical man, who called his attention to some fulness in the superficial veins of the abdomen. During the attacks of palpitation he would sometimes *become suddenly faint, fall down, and remain unconscious for a few seconds*. Examination revealed that he was well nourished and had a dark-red face. The veins of the right leg and abdominal wall were dilated and tortuous and there was one large vein in the right axilla. The left leg was affected to a minor degree. The

<sup>1</sup> THE LANCET, July 28th, 1906, p. 219.

<sup>2</sup> Transactions of the Clinical Society, vol. xxxi., p. 284, and vol. xxxiii., p. 34.

heart was beating feebly 54 to the minute, the apex was in the fifth space, one and a quarter inches to the right of the middle line, and a systolic murmur was heard at the apex. He was in hospital five weeks and the pulse varied from 54 to 32 with an average of 42 per minute. A provisional diagnosis was made of obstruction of the inferior vena cava by the pressure of a gumma or by phlebitis. He was given iodides for many years with some improvement. In 1905 he died in the London Hospital, aged 56 years, from peritonitis caused by perforation of the appendix; the only additional note made was that the abdominal veins filled most quickly from above.

At the suggestion of Professor W. Osler we have made a complete examination of the auriculo-ventricular connecting system<sup>3</sup> of muscular fibres of this heart to see if an explanation could be found for the marked diminution of the pulse-rate. The results of our enquiry throw a very definite side-light on the nature and function of the auriculo-ventricular connecting system. The symptoms led Dr. Chapman to diagnose some obstruction to the inferior vena cava of a syphilitic nature. The diagnosis was approximately correct, for there was some fibrous induration at the base and in the root of the right lung, but it was the superior, not the inferior, vena cava which was affected by the gummatous infiltration of the heart. The inferior vena cava at its entrance to the right auricle was nearly double its usual size, while the superior vena cava—lumen, wall, and orifice—was completely obliterated, only a small scar marking the site which it had once occupied (see Fig. 1, *a*, *b*). Since the musculature of the superior vena cava is believed to be the situation at which the heart's beat commences, it is important to determine approximately the date at which it was destroyed. The veins of the abdomen had been prominent for 13 years before death and at that period the man began to suffer from fulness of the head, palpitation, and fainting fits. About that time, or soon after, the musculature of the superior vena cava must have been destroyed. The collateral venous circulation appears to have opened up without causing any great inconvenience.

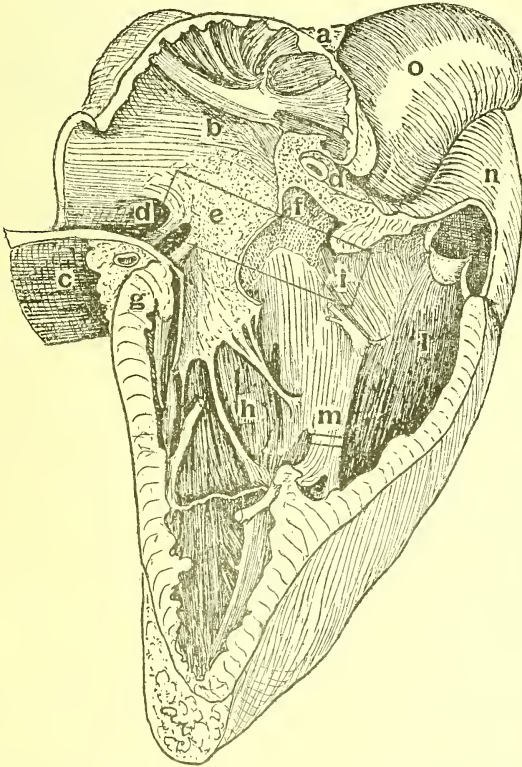
Since the musculature of the coronary sinus, as well as that of the superior vena cava, is derived from the sinus venosus one may suppose with good reason that the sinus may also be a site at which the heart's beat commences. In this heart the orifice and neighbouring parts of the coronary sinus are involved in, and form part of, a cicatricial mass which extends into and has destroyed all the musculature of the inter-auricular septum (see Fig. 1, *e*). The heart rhythm could not

<sup>3</sup> For an account of the auriculo-ventricular connecting system see article by Keith and Flack, *THE LANCET*, August 11th, 1906, p. 359.

have commenced at the coronary sinus in this case. The orifice of the coronary sinus was contracted; it measured 6 by 5 millimetres.

It is probable, but the statement lacks experimental proof, that the contraction of the left auricle may commence in the musculature surrounding the terminations of the pulmonary veins. In this heart that musculature was but slightly involved in the gummatous infiltration. The musculature of the vestibule<sup>4</sup> of the left auricle was only slightly damaged, but all the

FIG. 1.



Two-thirds natural size. Heart, showing the septal wall of right auricle and ventricle. *a*, Remnant of superior vena cava. *b*, Position of orifice of superior vena cava, quite closed. *c*, Greatly dilated inferior vena cava. *d*, Fossa ovalis. *e*, Cicatricial tissue of interauricular septum (stippled). *f*, Pars membranacea septi and extension of cicatricial tissue into interventricular septum, in which the auriculo-ventricular bundle is involved. Between *d* and *e* is the opening of the coronary sinus. *c*, *i*, The block cut out for examination. *g*, Base of right ventricle. *h*, Body of right ventricle. *l*, Infundibulum. *m*, Moderator band with plane of section indicated. *n*, Pulmonary artery. *o*, Aorta.



musculature of the sinus of that chamber (Fig. 2, *b*), including the left *tænia terminalis*, was reduced to a ring of cicatricial tissue—a ring only 15 millimetres in diameter, yet evidently large enough to allow the pulmonary blood to reach the left ventricle without offering any grave impediment to its flow. The ring of cicatricial tissue cut off the musculature of the vestibule of the left auricle from the rest of the musculature of the heart, so that it must have kept its own independent rhythm.

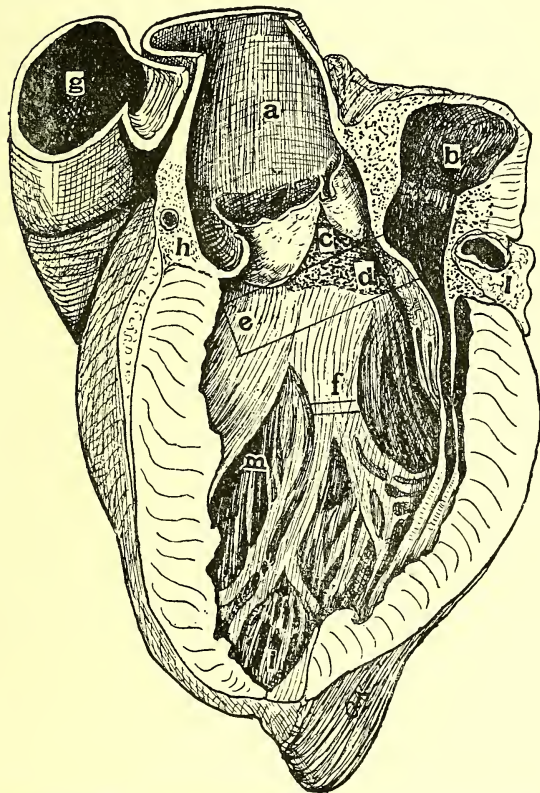
From Figs. 1 and 2 it will be seen that the cicatricial tissue included a considerable area of that part of the inter-ventricular septum in which the auriculo-ventricular bundle is situated. We cut from the heart that part of the cardiac septum indicated in Figs. 1 and 2, and having removed the calcareous deposits which were in it by the use of sulphurous acid, made a series of vertical sections along the block from the anterior or ventricular to the posterior or auricular end. The sections were cut serially,  $10\mu$  thick, and treated by Van Gieson's stain, three sections being mounted from each millimetre of the block. For his assistance in this laborious work we are greatly indebted to Mr. W. Chesterman. In the anterior or ventricular part of this block we found the main auriculo-ventricular bundle and its right and left septal divisions apparently healthy; perhaps the connective tissue which enters normally into their formation was in excess, but with the microscope we could detect no feature that indicated a pathological condition in the bundle. If anything the bundle and divisions are larger than is usual. The continuation of the septal division, seen on making sections at *m*, Fig. 1, and *f*, Fig. 2, showed the normal fibres of the auriculo-ventricular system. As we followed the bundle backwards its muscle was found to be gradually replaced by fibrous tissue, so that 15 millimetres of the main bundle, the whole of the network in which the bundle begins and all the auricular musculature in the vicinity of the network, were reduced to dense fibrous tissue—much of it being in the form of amorphous material in which calcareous deposits were present.

It may be safely assumed from the symptoms observed by Dr. Chapman and in the London Hospital and from the condition of the cicatricial tissue that the muscular connexion between auricles and ventricles had been destroyed several years (probably thirteen) before death, yet the complete section of the bundle has not resulted in any visible atrophy beyond the point of destruction. Were this peculiar system, so well described by Tawara, only a conducting pathway for the auricular stimuli into the ventricle one would expect degeneration in the system of fibres beyond the point of section, for it may be taken as an axiom in biology that abrogation of function is invariably followed by atrophy. This case lends

support to those who regard the auriculo-ventricular system of fibres as concerned not only in conducting but also in originating the impulse which leads to the contraction of the ventricular musculature.

We have not yet finished the list of lesions in this remarkable case. The cicatricial tissue involved the orifice of the aorta and especially the openings of the right and left coronary arteries. The orifice of the right coronary artery measured

FIG. 2.



Two thirds natural size. Left side of the heart is removed. *a*, Aorta. *b*, Contracted left auricle (stippling shows the extent of the cicatricial tissue). *c*, Pars membranacea septi; the stippled area below shows the extension of the gummatous tissue into the interventricular septum, in which the auriculo-ventricular bundle is situated. *d*, *e*, The block cut out for examination. *f*, The left septal division of the bundle (the line of section is indicated). *g*, Pulmonary artery. *h*, Cicatricial tissue at origin of aorta. *i*, Coronary sinus. *m*, Localised dilatation of the left ventricle.

1.4 by 1 millimetre; along its course many irregular thickenings of the wall were seen. The posterior branch of the left coronary artery was almost obliterated; halfway along

its course the anterior interventricular branch showed thickenings in its wall which narrowed the lumen to half its normal size. Any obstruction to the flow of blood along the anterior interventricular artery is always followed by the peculiar localised dilatation of the left ventricle, which is shown in Fig. 2, *m*. From the condition of the arteries we may infer that the blood-supply of this heart had been reduced to half the normal amount, probably even less than half.

To sum up, the heart of this man was reduced to the following condition: the superior vena cava was completely destroyed; the coronary sinus was involved in a cicatrix; the sinus of the left auricle formed a cicatricial ring; the inter-auricular and part of the interventricular septum formed a cicatricial lamina; the commencement and upper half of the main auriculo-ventricular bundle were completely destroyed; and the coronary arteries were partially occluded. Yet with the complete separation of the musculature of the auricles and ventricles there had been only passing syncopal attacks some 13 years before, which was probably the date at which the auriculo-ventricular bundle was first invaded by the infiltration; there were no signs of heart failure, and there were no urgent symptoms of insufficiency of the heart's action.

The lesson to be drawn from the case appears to be that the normal mechanism of the heart may be profoundly changed without a great disturbance of function, provided that these changes are not brought about too suddenly. The recovery which followed the initial syncopal attacks was probably due to the auriculo-ventricular system persisting beyond the point of lesion and taking on an automatic power of originating ventricular contraction. Unfortunately, the routine method of examining the heart does not give us exact facts relating to the action of the several parts of the heart. The lack of such data shows us the necessity of applying to the heart the exact methods of the physiologist, as has been done with success by Mackenzie and Wenckebach.



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THE IMPORTANCE OF  
THE HYPHOMYCETES.

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